

Monsoonal variation of the marine phytoplankton community in Kota Kinabalu, Sabah

ABSTRACT

Monsoon-driven changes of environmental factors have been reported to be significantly variable and affects the phytoplankton community in tropical waters. This study examined the monsoonal changes of environmental parameters and the coastal phytoplankton community, including potential harmful algal bloom species, in the waters of Kota Kinabalu, Sabah, Malaysia. Bi-weekly observations were conducted from August 2017 to January 2019, covering the Southwest Monsoon (SWM), Northeast Monsoon (NEM), and inter-monsoon periods (IMPs). Sea surface temperature, salinity, and daily average photosynthetic active radiation (PAR) were significantly different between the SWM and the NEM. Total phytoplankton densities were significantly higher in the SWM with median cell densities of 1.12×10^4 cells L^{-1} compared to the NEM with 3.98×10^3 cells L^{-1} . Nutrient measurements indicated that the waters were mesotrophic, with low phosphate (P) levels ($<0.3 \mu M$ -P on average). N:P ratios were often above the Redfield ratio (16N:1P), while high Si:N (>1) and Si:P ratios ($>16Si:1P$) indicated that silicate was not limiting, a condition favourable for diatom growth. Phytoplankton dynamics shifted from a dinoflagellate-dominant community (*Prorocentrum* spp. and *Prorocentrum* spp.) to a diatom-dominant community (*Leptocylindrus* spp. and *Dactyliosolen* spp.) during the NEM, which was preceded by a peak in silicate and nitrate. Later, *Chaetoceros* spp. became dominant during the second SWM. The presence of intermittent increases in *Margalefidinium polykrikoides* and *Pyrodinium bahamense* var. *compressum* cell densities may trigger future blooms in these waters. Canonical Correspondence Analysis suggests that the dinoflagellate-dominant community was driven by changes in PAR and Si:N while changes in N:P and salinity shaped the diatom-dominant community. The shifts of the phytoplankton community composition in relation to the different monsoonal periods suggests that the monsoons function as environmental drivers which structure the phytoplankton community of this coastal ecosystem.